NERRS Science Collaborative Progress Report for the Period 09/01/10 through 02/28/11
Project Title: *Legacy effects of land-use change and nitrogen source shifts on a benchmark system: Building capacity for collaborative research leadership at the Grand Bay Reserve*

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Report compiled by: R. H. Carmichael (PI)

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A. Progress overview: State the overall goal of your project, and briefly summarize in one or two paragraphs, what you planned to accomplish during this period and your progress on tasks for this reporting period. This overview will be made public for all reports, including confidential submissions.

Research goal

To measure land-use related N source and pathogen changes through time and define the resulting effects on ecosystem and human health in Grand Bay, AL by combining data from land-use models, sediment cores, modern sediment and water samples, ancient shell middens, living native and transplanted bivalves, and environmental attributes that cover time periods from up to 3000 years before present to 2020 for three subwatersheds and their receiving waters.

Planned activities and anticipated accomplishments

For this term (Q1 & Q2), we planned to complete our final site selection, start land-use research and preliminary modeling efforts, initiate midden sampling and shell dating, locate and sample relevant wastewater sources, design and begin operating a website and discussion board, engage in at least one Working Group meeting (of research investigators) and one Participant meeting (including core end user participants), and begin training students and technicians on technical methods (particularly stable isotope and microbial analyses).

B. Working with Intended Users:

- Describe the progress on tasks related to the integration of intended users into the project for this reporting period.
- What did you learn? Have there been any unanticipated challenges or opportunities?
- Who has been involved?

1. We conducted one Working Group meeting in Sep 2010 at which PI, Co-Is, Integration Lead, associated NERR staff, and a core student researcher reviewed project goals and brain-stormed for opportunities to a) increase participation by existing end-user participants and b) reach out to additional potential end users. We identified several possible new end users and assigned action items to reach out to and invite them to participate (meeting arranged by Carmichael and Walton; lead by Carmichael).

2. Integration Lead, Walton, created and began maintaining a project
   a. Facebook Page: http://www.facebook.com/pages/Grand-Bay-National-Estuarine-Research-Reserve-Science-Collaborative/153046948084497 (open to the public)

   b. Google Discussion Group (by invitation only for closed participant discussions)

3. Integration Lead, Walton, coordinated and planned a Participant meeting to be held 4 Mar 2011 to allow end-user participants to meet the full team of research investigators and discuss potential project improvements. An earlier meeting planned for Oct 2010 had to be cancelled due to low End-user Participant attendance, and we learned that one of the core end-users was diagnosed with cancer, making coordination among treatments difficult. We are in the process of identifying another individual who can work with this end-user to attend meetings when they are not available and help fill this position.

4. Grand Bay NERR Director and Co-I, Ruple, discussed the Science Collaborative project with representatives from the Mississippi Department of Marine Resources (DMR) and Department of Environmental Quality and invited them to the next stakeholders meeting (Scott Gordon, the Shellfish Coordinator from DMR and Coen Perret, the Pascagoula River Basin Coordinator from DEQ). The project should have significant relevance to their ongoing work for the state. He is still working on a meeting with the Jackson County Port Authority, to learn more about their water treatment facility near Bangs Lake, one of our study sites.

5. PI Carmichael and student E. Condon met with end-user participant, E. Jackson, an archeologist at USM in Hattiesburg, MS in Feb 2011 to make final selection of sites from which sampling and analyses of midden shells will be most beneficial to both of our projects. We also discussed opportunities to coordinate outreach and end-user activities that have potential to be mutually beneficial to our projects.

- Has interaction with intended users brought about any changes to your methods for integration of intended users, the intended users involved, or your project objectives?
- How do you anticipate working with intended users in the next six months?

No significant changes to-date. We anticipate opportunities for refinement after the Participant meeting 4 Mar 2011. We additional anticipate greater input from expanded outreach efforts described above under # 1 - 4.

C. Progress on project objectives for this reporting period:

- Describe progress on tasks related to project objectives for this reporting period.
- What data did you collect?
- Has your progress in this period brought about any changes to your methods, the integration of intended users, the intended users involved or the project objectives?
- Have there been any unanticipated challenges, opportunities, or lessons learned?

Preliminary site visits and field sampling

Student E. Condon, PIs Carmichael and Calci visited the research site (Grand Bay NERR, MS) to select sites for water quality monitoring and oyster deployment. We took preliminary water samples, native oyster samples, and water quality data to help choose sampling locations (Sep 2010).

Condon visited field sites with anthropologists working under end-user Participant Jackson (MSU) who is mapping and excavating the oyster shell middens. She observed sampling methods and learned the relevant history of the middens and geology of the region. Condon collected shell midden samples for stable isotope analysis and Carbon dating. She additionally tested sediment coring techniques in the field and sectioned them in the lab (Sep 2010).

Condon has arranged to accompany a technician working with Dr. J. Cebrian's on an ongoing EPA funded project in Grand Bay to visit and take preliminary samples at the newly added site, Bayou Chicot in March 2011 (Feb 2011; see section on *Land use modeling* for details on this 'methods change' and 'opportunity').

Lab work and data analyses

Student Condon processed samples from the September field trip and sent them to the U.C. Davis Stable Isotope Facility for analysis (Dec 2010). Data were analyzed in Jan 2011 to inform sampling efforts in Summer 2011.

From observations made during the September field trip, Condon and Carmichael planned the sediment core sampling and ordered necessary supplies, along with lab supplies for isotope and microbiological sampling from core sections (Jan 2011).

Condon created preliminary GIS maps of selected sites (Jan 2011).

Condon and Carmichael began processing "practice" shell samples provided by end-user participant, Jackson (USM) from midden sites (Feb 2011).

PI Carmichael, Integration Lead Walton, and student Condon collaborated to plan and determine needs for cultured oysters, which will be obtained from the Auburn University Shellfish Lab for field deployments in Summer 2011 (Feb 2011).

Technical training

Co-I Calci (FDA) trained Condon on laboratory techniques for the microbiology component of the project. At the FDA Gulf Coast Research Lab on Dauphin Island, she learned the basics of sampling for *E. coli*, fecal coliform, and male-specific coliphage (MSC) in water samples (Sep 2010 – Jan 2011).

Condon took DISL's two-week vessel certification class and became certified to operate and tow DISL boats for use at the Grand Bay NERR (Oct 2010).

Condon attended a one-day workshop at DISL on Metadata Creation, which will support data management and dissemination activities for the project (Nov 2010).

Condon attended a three-day NOAA workshop on Coastal GIS, which will support creation of data layers for analysis and data display for the project (Jan 2011).

Co-I Calci (FDA) trained student Condon on the iron-milk method for *Clostridium perfringens* detection in sediment samples at FDA (Jan 2011).

PI Carmichael and technician trained Condon on shell cutting techniques in the Carmichael lab for application to midden shells provided by Jackson (USM) (Feb 2011).

Land-use modeling

PI Carmichael, student Condon, and Co-Is Wu and Ruple, along with associated NERR staff met with Dr. J. Cebrian (DISL) to discuss potential collaboration and cooperation between the NSC project and Dr. Cebrian's ongoing EPA project at the Grand Bay NERR. Watershed delineations developed and ground-truthed by Cebrian and colleagues will inform modeling efforts by Co-I Wu. From this meeting we determined that collaboration will leverage data collection and enhance outputs from both projects. Based on input from Cebrian, we also decided to add a fourth study site, at Bayou Chicot, to serve as a more altered endpoint to comparison (Jan 2011).

Co-I Wu started the spatial data collection, including digital elevation models (DEM) and Landsat images from USGS, land cover/use maps based on Landsat images from NOAA, and land cover with higher spatial resolution based on Quickbird images in 2006 from GBNERR (Sep – Dec 2010).

Wu additionally downloaded 3-meter resolution DEM from USGS, and applied the HydroTool in ArcGIS to delineate the river networks and watershed boundaries based on elevation within GNERR and its upper-watershed areas. Wu is in the process of comparing the delineation she created with that generated by Cebrian and colleagues in collaboration with the Grand Bay NERR (Jan – Feb 2011).

- What are your plans for meeting project objectives for the next six months?

  We will continue collecting and processing data from sediment cores and shell middens, sampling native bivalves, and we will begin regular measurements of estuarine attributes at each study site identified during this term. We will continue stable isotope and microbial analyses on sediment and water samples, begin measuring bivalve growth and survival based on native collections and core captures. We plan to continue land-use research and modeling efforts as described. We will continue operation and maintenance of the Facebook page and Google discussion board, make at least one public or scientific presentation to share data from the project, as well as continue data analyses and student and technician training.

D. Benefit to NERRS and NOAA: List any project-related products, accomplishments, or discoveries that may be of interest to scientists or managers working on similar issues, your peers in the NERRS, or to NOAA. These may include, but are not limited to, workshops, trainings, or webinars; expert speakers; new publications; and new partnerships or key findings related to collaboration or applied science.

PI Carmichael and student Condon attended the Gulf Estuarine Research Society (GERS) meeting in Port Aransas, TX. This meeting provided an opportunity to learn more about other regional projects, including insights from projects that involved similar approaches to sediment coring and sampling ancient shells (Nov 2010)

PI Carmichael, Condon, Integration Lead Walton, and associated NERR staff attended the Mobile Bay National Estuary Program's Bays and Bayous Symposium in Mobile, AL. This meeting provided an opportunity to interact with a broad range of researchers, students, and others also working in Grand Bay and nearby waters of the Northern Gulf of Mexico (Dec 2010).

We established a collaboration with Dr. J. Cebrian (DISL) to share land-use and watershed delineations developed and ground-truthed by Cebrian and colleagues, which will inform modeling efforts by Co-I Wu for this project. This collaboration will leverage data collection and enhance outputs from both projects at the Grand Bay NERR (Jan 2011).

E. Describe any activities, products, accomplishments, or obstacles not addressed in other sections of this report that you feel are important for the Science Collaborative to know.

Co-I Wu advertised a post-doc position, which will be supported by this project and a related project, and is in the process of hiring. Wu expects the post-doc (Dr. Chongfeng Guo from China) to take the lead on the land-use change analysis, which fits well with Dr. Gong's expertise.